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The Role of Library Research Instruction in Developing Teachers' Problem Solving Skills

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O'Hanlon explores how library research skills, critical thinking abilities, and problem-solving skills can be developed in preservice programs. The utility of the guided design methodology for strengthening these skills is discussed and illustrated.

In the beginning of the twentieth century, John Cotton Dana, a librarian, wrote: "All knowledge is in print, or will be tomorrow. To know how to find in books and journals just the information you need - that is to hold the eel of wisdom by the tail" (in Harris, 1934, p. 87). Dana recognized that real knowledge is, like the eel, a slippery and elusive prize that requires critical evaluation of a variety of evidence and of viewpoints expressed by different writers over time. The development of critical, evaluative skills is a complex process, one in which students learn to solve problems rather than merely find correct answers. Without good information-finding skills, however, students are not likely to locate the necessary materials that will enable them to solve the problems they face. Moreover, in the "real world," information for use in problem solving must often be sought from 3. number of sources -knowledgeable persons and institutional sources 3.s well as written materials. Few entering college students are skilled at locating information resources. Moreover, many lack the analytical skills needed for the critical evaluation of information once it is found. Formal instruction in library research and information-seeking methodology offers a vital opportunity to strengthen and support the teaching of critical thinking skills.

Recognizing that prospective teachers in particular need instruction in research skills in order to successfully guide their pupils development, committees from the National Education Association and the American Library Association formulated standards for library instruction in teacher colleges in 1906, 1912, and 1915 (Harris, 1934, p. 88). Over the decades, the call for mandatory library instruction in the teacher training curriculum has been repeated often in the professional literature of librarianship and of education, yet little progress can be seen in achieving this goal (for example, see Borromeo, 1937; Garber, 1954; Clark, 1960; American Association of School Librarians, 1961). Evidently, the rhetoric of activists failed to convince those charged with preparing teachers of the practical and pedagogical value of research skills instruction. Further, the methods of instruction usually offered by librarians have failed to reinforce the teaching of critical, evaluative skills. Typical library instruction sessions often focus on descriptions of features of print information sources rather than on developing the conceptual framework or "cognitive map needed for an understanding of how information is produced and disseminated and of processes for locating and appraising information in many formats.

This paper argues that library research skills instruction aids the development of critical, evaluative faculties in teacher trainees. It examines current research and critical competencies of

student teachers, describes a problem-solving simulation method for teaching library skills, and presents the benefits of incorporating library instruction in the teacher training curriculum. A brief review of some current ideas on appropriate means and methods for teaching critical skills is provided first as a context for this discussion.

Teaching Critical Thinking Skills

Can we be taught to think critically? If so, how should we approach this task? Obviously, we already know how to think, but it is possible to improve the thinking process and to foster better analytical skills. Halpern (1984) states that when we think, "we take new information, combine it with information stored in memory and end up with something more than and different from what we started with (p. 4). She defines critical thinking as a process that is purposeful and goal-directed. Psychologist Robert Sternberg (1982) characterizes reasoning in a similar fashion, that is, as an attempt to combine elements of old information to form new information. The old information may be external (from books, magazines, newspapers, etc.), internal (stored in memory), or a combination of the two" (p. 235).

Numerous others have provided more detailed definitions of the term *critical thinking.* Although some writers use variant terminology, most identify skills or operations that focus on the ability to draw logical inferences and to analyze and evaluate information presented. While it is not the intention of this paper to scrutinize the nature of these skills or to draw fine distinctions, some clarification of the terms *critical thinking skills* and *problem-solving skills* is needed. A related term, *research skills,* is considered later. Use of the phrase "critical thinking skills" here refers to that complex set of skills including analytic, deductive, and evaluative abilities. Although Beyer (1985) asserts that critical thinking and problem solving are not the same processes, they are certainly closely related tasks. Sternberg (1982) notes that while the relationship between them has always been fuzzy, "problem solving seems to require reasoning, and reasoning seems to require problem solving" (p. 227). In this paper, *problem solving* denotes the identification and critical analysis of options, as well as the process of decision making. Students' critical thinking skills may be developed by repeated practice with problem-solving exercises of various kinds.

However, attempts to teach problem-solving skills are hampered by the prevalent student attitude that there is a right answer to every question, a correct solution to every problem. Perry (1970) identified four stages of intellectual and ethical development. He felt that most students enter college with a dualistic world view, believing that right and wrong are polar opposites and that right answers can be easily identified. As development progresses, the student recognizes the multiplicity of possible opinions on a question and ultimately acknowledges that few things can be known absolutely; consequently, rational, critical choices must be made.

Sternberg (1985) notes that much critical thinking instruction involves having students find answers to neatly structured problems when real-life problem situations are frequently messy and ill-structured: "Everyday problems generally have no one right solution, and even the criteria for what constitutes a best solution are often not clear" (p. 197). A neatly structured approach to teaching critical skills only reinforces the dualistic' view of right/ wrong and does little to encourage the complacent student to test the uncertain terrain off conflicting value systems.

Sternberg identifies other deficiencies in many critical thinking instruction programs. The typical problems posed in critical thinking courses contain much of the information needed to solve them; yet, "in everyday problem solving, it is not usually clear just what information will be needed to solve a given problem, nor is it always clear where the requisite information can be

found" (p. 196). Further, everyday problem solving is often done in groups or by committees, task forces, and working groups of various kinds. Because groups are susceptible to biases, individual problem solving methodology does not adequately prepare students to confront the real-world exigencies of group decision making. Techniques for teaching problem-solving skills that incorporate the need to locate and evaluate information for decision making and to support arguments with evidence would overcome some of the deficits described by Sternberg. The guided design simulation method, an approach to developing critical skills that utilizes open-ended group techniques, will be discussed later in this paper.

Another question related to the teaching of critical skills is posed by Ennis (1985): How is critical thinking instruction best incorporated into the curriculum? Are separate courses preferable to incorporating critical skills instruction as a part of existing courses? He concludes that both are probably necessary at the college level, at least until critical thinking instruction becomes embedded in the elementary and secondary school curricula. At present, a separate course can be useful for efficiently introducing basic principles of critical thinking. Ennis warns, however, that "the need for the practice of critical thinking within the other courses will not diminish since critical thinking about the subject is an integral part of the study of most subjects" (P- 31).

If critical thinking instruction should properly begin in the elementary and secondary years, we must ask whether elementary and secondary school teachers are adequately prepared to present this instruction. Do most teachers themselves possess the critical, evaluative skills that we ask them to foster in their students? How can these skills be incorporated in the teacher training program in light of the preceding cautions presented by Sternberg? What role does library research skills instruction play in this process? Finally, what benefits might student teachers, teachers, and pupils accrue from an enhanced program of research and critical skills instruction in the teacher preparation curriculum?

Do Teachers Lack Critical Thinking Skills?

A number of studies have asserted that at least half of college freshmen do not demonstrate reasoning or analytic skills that are sufficient to facilitate problem solving (Tuckett and Stoffle, 1984, p. 61). Testimony cited in *A Nation At Risk* stated that "nearly 49% [of seventeen-year olds] cannot draw an inference from written material; only one-fifth can write a persuasive essay ..." (National Commission on Excellence in Education, 1983, p. 9). An article in the *Chronicle of Higher Education* indicated that "many professors report that they no longer take it for granted that their students can analyze arguments and reason thoughtfully by the time they reach college" (McMillen, 1986, p. 23).

Do student abilities improve with college training? A recent study by Keeley and colleagues (1982) suggests few gains in student reasoning and critical abilities after four years of undergraduate study. Keeley used a series of open-ended questions as well as a single broad essay question to measure the critical skills of freshmen and seniors and to determine the impact of college courses on thinking skills. He found that while seniors surpassed freshmen in performance on a number of measures, the absolute differences were not very large. The author suspects "that the lack of differences [on specific cognitive tasks] better reflects an inability of the student to perform the operations because of insufficient practice and reinforcement of skills" (p. 152). If researchers believe that students enter college with underdeveloped critical skills and leave academia in much the same condition, is there any reason to think that students enrolled in teacher training programs are different?

While much has been written about the need for adding or strengthening library research skills instruction in the teacher training curriculum, existing studies of student performance in this area are often little more than tests of rudimentary finding skills such as interpreting cross references or elements of periodical index citations (see Perkins, 1965; Walker, 1967). However, data from several recent surveys provide some insight into attitudes of teachers and faculty at teacher training institutions concerning the library research skill competencies of teachers.

LeClercq (1986) surveyed eleventh and twelfth grade high school teachers in the Knoxville, Tennessee, area in connection with a project promoting high school and college library cooperation in teaching library research skills. Her data indicate that many responding teachers feel unqualified to teach library skills to their students. While 69 percent of the English teachers surveyed do feel prepared to teach these skills, two-thirds of all other teachers in her population said they are not adequately prepared in this area.

In a recent survey of attitudes of Ohio elementary education college and university faculty toward library skills instruction in the curriculum, O'Hanlon (1987) asked the respondents to assess the library research skills of their students, the role of the teacher in providing research skills instruction for elementary school pupils, and the ability of current teacher trainees to provide instruction. Almost two-thirds indicated that lower-division students in their classes displayed inadequate library skills based on evaluation of their research projects. When assigning research projects, 75 percent of the faculty respondents assumed that upper division students knew how to use library resources, but only 49 percent reported that these students displayed adequate library research skills based on assignments received.

When asked about responsibility for providing library skills instruction to pupils, 61 percent of the respondents favored shared responsibility between classroom teacher and school librarian, and more than 80 percent indicated that the teacher should be involved in some way in the instruction process. How well prepared are teachers for this task? Even those who have developed adequate library research skills have had little preparation for teaching them. Almost half, or 48 percent, of respondents indicated that they believe graduates of Ohio elementary teacher training programs are not adequately prepared to teach their students library research skills.

If one can assume, then, that teachers generally lack adequate preparation to address research problems in a critical manner, what can be done to remedy this situation? The following suggests a rationale for incorporating both research and critical thinking skills instruction in the teacher education curriculum in a manner that overcomes some of the deficiencies of critical skills training described earlier.

Teaching Library Research Skills to Reinforce Critical Skills

Critical evaluation of information sources located during the process of library research is essential to producing a quality research product. Many student research papers seem to be syntheses of information selected indiscriminately from the most easily available or accessible sources. Poor quality reflects not only haste but also weak critical skills. Strengthening students' critical skills will ultimately increase their ability to do sound, productive research. Conversely, the library research process, because it is a problem-solving activity that requires students to engage in tasks such as analyzing and evaluating information sources, drawing inferences, and making decisions about relevance, is an ideal avenue for advancing development of student critical skills.

While this synergistic relationship between library research skills and critical thinking skills may seem obvious, it has not always been recognized by educators. Instructors at all levels assign research projects that do little to develop or enhance student critical skills but instead merely require students to find and regurgitate facts or "correct" answers. From elementary schools to university settings, librarians preach the gospel of library skills instruction as a necessary part of every student's basic education. Yet library educators have too often been preoccupied with teaching about specific reference tools instead of information finding as a process that also provides opportunities for the development of critical skills. McCormick (1983) believes that library educators must go beyond dry and boring lessons in library procedures and must instead provide students with experiences that encourage development of thinking skills. Mancall and her colleagues assert that many existing programs are library-centered rather than information-centered, concentrating on the physical objects collected rather than their intellectual contents; (Mancall, Aaron, and Walker, 1986, p. 20). They advocate "information management skills," instruction that is broad, process-oriented, and helpful in assisting students in planning successful strategies for solving problems.

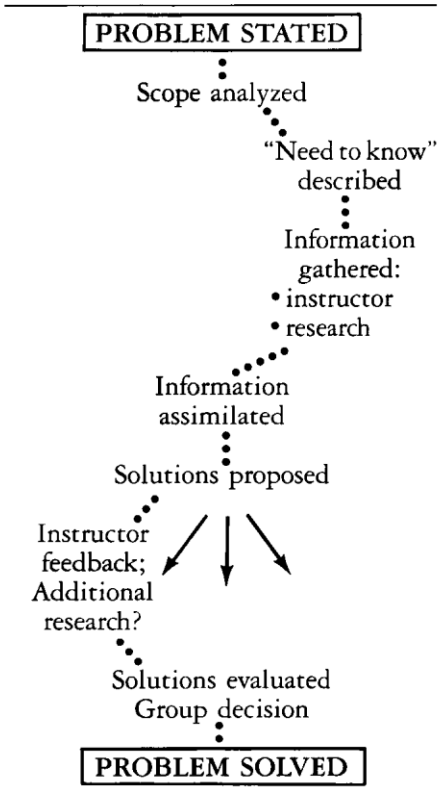
Based on her review of research related to metacognition, Bertland (1986) suggests ways in which research skills instruction can be linked to strengthening critical skills. While her proposals are aimed at elementary school librarians and media specialists, they are certainly applicable for library educators at all levels and are particularly appropriate for use with prospective teachers. Bertland observes that since one means by which students improve critical skills is through observation of appropriate models, teachers
and librarians can help students learn to reflect on or think about their thinking processes through the conscious example of their own classroom behavior. Thinking out loud when planning approaches to a problem or when developing strategies and generating questions as material is read is a teacher-modeled behavior that is useful for fostering awareness of critical skills. Bertland concludes that tasks or projects requiring problem solving should be done in small groups in which students can keep records of their goals and strategies and can question and evaluate each step of the solution process.

Applying these findings to the development of an information management skills curriculum that fosters critical abilities, Mancall, Aaron, and Walker (1986) propose that frequent opportunities be provided for students to develop questions related to information problems and to solve information-related problems in groups. While their focus is on elementary and secondary students, they add that the "requirement that students project strategies at the initiation of assignments and critique those same strategies at the completion of assignments" (p. 25) is equally valuable for college-level learning activities involving research. One way to increase the learner’s active involvement is through the adoption of a teaching methodology that promotes the use of reasoning and problem-solving skills.

One such method, described by Wales and Stager (1978), is guided design. This method is centered on small-group work and open-ended problem-solving activities. Originally developed for engineering students at West Virginia University, guided design was eventually adopted by instructors in a wide variety of disciplines. Problems are structured yet have no single correct answer, so that students must carefully examine alternatives and find a feasible solution. Guided design activities are carefully organized so that each problem is broken down into a sequence of decision-making steps. The group discovers early in the process that certain information and skills are needed in order to make appropriate decisions. After arriving at decisions, group members are given instructor feedback on strengths and weaknesses of their approach before proceeding to the

next stage of the process (see Figure 1).

Figure 1
The Guided Design Model



Wales and Stager share Sternberg's concern that the instructional process approximate the "real-life" experience, where few problems are susceptible to a single solution, and where many different opinions and values must be considered and reconciled in the decision making process" (Wales and Stager, 1978, p. 5). Students in education classes might particularly benefit from repeated exposures to solving "real-life" problems early in their training program and in having an awareness of strategies for critically examining those problems.

Wales and Stager conclude that use of this experiential method not only provides modeling and efficient practice for development of critical skills but also increases mastery of subject content, since student motivation is improved. Further, the guided design method incorporates many of the tasks described in Bloom s Taxonomy providing repeated practice in analysis, synthesis, and evaluation of information located through library research or other means.

Because finding, sorting, evaluating, and using relevant information is a key to successful decision making and an inherent part of the guided design methodology, this process is especially suited for strengthening future teachers' critical thinking and research skills at the S3, me time. Library educators Oberman (1982) and Mellon (1982) are in the forefront of those who have advocated problem-solving approaches to teaching information skills.

Oberman describes library research as a process that contains all the elements of problem solving. The researcher must perform a needs analysis to determine the shape and scope of the research problem. As information is gathered, the researcher recognizes links between information

sources. *DV* finding the key sources on a topic and locating related research linked to these sources through citations, the researcher can begin to evaluate the impact that one piece of research has had on the thinking of other writers and assess the validity of the claims presented. Oberman also demonstrates how the library research process mirrors the "Steps in Decision-Making," which Wales outlines in his guided design model. Finally, Oberman provides an example of how the guided design methodology can be adapted to fit a problem solving assignment for a public administration class. At each stage of the process, information is sought, sifted, and evaluated for use in resolving an aspect of the problem.

Teachers frequently complain that their education courses were not relevant to the real world of the classroom, that they have not been prepared to organize courses or plan lessons but rather have focused too heavily c i theory (Roth and Adler, 1985, p. 4). Whether or not this complaint is valid, others have argued that beginning teachers frequently lack the ability to plan and organize the curriculum for pupils (Martin, 1983, p. 4). The guided design model could be easily adapted to fit an assignment requiring education students to work in groups to plan and organize a specific curriculum for pupils. This type of exercise would provide practice in locating appropriate information sources and would simultaneously foster a number of critical and problem-solving skills as well as teach planning skills to prospective teachers. These students would be better prepared to tackle the "how" of teaching and also more likely to ask and examine critically the "why" and "what if questions. As Dewey wrote, "It is possible for students to acquire outward form of method without capacity to put it to genuinely educative use" (Roth and Adler, 1985, p. 5). Increased use of methodologies such as guided design in the teacher training program will enable those students to practice their craft more skillfully and to search for and analyze information that can aid in the reflective examination of practice.

Gains for Teachers and Pupils

What can teacher educators glean from the preceding observations that will enhance their efforts to train teachers who can think critically? First, information-seeking skills instruction can be a valuable tool for developing teachers who are competent problem solvers. The research process is not an adjunct to problem solving but an integral part of it. In order to develop teachers who value and promote critical and analytical skills in their classrooms, teacher training curricula must incorporate methods such as guided design along with frequent, independent, research-oriented learning activities so that teachers can learn and practice skills they can pass on to their pupils.

Teachers influence pupils' attitudes in many areas. Several studies have demonstrated that the classroom teachers' previous library-related experiences, competencies, and attitudes toward research and library use greatly influence students' attitudes (see Griffin, 1980; Rogers, 1977). Moreover, lack of library and research skills on the part of the teacher usually results in poorly devised library research assignments that frustrate and discourage pupils because of the difficulty involved in finding answers or £Lppropri3.te materials. Librarians in all types of academic settings frequently encounter students with library research assignments that appear deceptively simple but actually require complex and well-developed research skills. Teachers with better knowledge of research sources and processes gained through a variety of practical experiences would be more likely to recognize the need to work with librarians to devise assignments that promote learning rather than fear or frustration.

Teacher behavior also exerts a profound influence on development of pupils' thinking

skills. Hunt (1975) notes that the kinds of questions asked, the ideas elaborated upon and those passed over, and the teacher's messages conveying approval and disapproval are all areas in which a teacher exerts either positive or negative influences on students' critical abilities. In a study of the relationship between critical thinking abilities of teachers and their verbal classroom behaviors, Hunt and Germain (1969) found that those teachers who scored high on the Watson-Glaser Critical Thinking Appraisal made a significantly greater number of classroom comments displaying convergent, evaluative, and divergent thinking. These teachers also made a significantly greater number of comments that were supportive of pupils. The authors note that verbal support or reinforcement by adults increases motivation levels and the quality of student performance, especially for lower-ability students. Finally, the teacher-stated purposes and goals were more evident in the classroom behavior of the teachers high in critical thinking ability. Hunt and Germain conclude that because of the teacher's profound influence over development of critical skills, "teaching for critical thinking must have its beginning in teacher education courses and inservice teacher training" (p. 7).

Because teacher education students as well as others come to the college classroom with underdeveloped critical skills, one course or a few isolated opportunities to develop critical thinking skills are not sufficient. .education students require constant and consistent practice of these skills. Students should be encouraged to develop a questioning attitude, to consider all possible sources of information, and to develop skill in gathering data and in recognizing relationships and reorganizing previously acquired knowledge (Hunt and Germain, 1969). Because the library research process incorporates all of these elements, one way to foster the development of critical skills in teacher trainees is to instruct students in research methodology and to provide them with well-structured opportunities to develop and use research and problem-solving skills throughout the teacher training curriculum.

A number of writers have noted that practicing teachers show little interest in applying research findings to classroom practice, perhaps because research findings are not disseminated in forms readily available to teachers or because the studies are judged to be impractical or irrelevant (see Huling and Johnson, 1983; Eisner, 1984). Certainly, teachers gain little practical experience as researchers during their undergraduate years (see O'Hanlon, 1987). Since teachers infrequently receive training in research methodology, it is not surprising that they find it difficult to identify with or appreciate the work of the educational scientist. Thus, a further benefit of increased attention to library research and critical skills training for teachers might be a greater understanding of and respect for educational research and an improved ability to evaluate the relevance of research studies for classroom practice. An added benefit to be gained from the guided design approach, for example, is increased teacher competency in group decision making. Perhaps this experience can encourage a more colleagial approach to problem solving in classroom settings, providing support for beginning teachers and enhancing the work environment of more experienced ones.

Teacher educators can effectively develop teacher candidates who are able to think on their feet and who have well-developed resources for researching and solving problems in their practice areas. The integration of required research and problem solving skills into the teacher training curriculum will help develop the necessary critical thinking skills in prospective teachers. By providing numerous structured opportunities for students to solve relevant and practical problems through the use of critical thinking and research skills, teacher educators may achieve the synthesis of theory and practice toward which they strive.

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